

REMARKS

A. Status of the Claims

Claims 3-4, 9, 11, 13, 15, 17, 19-20, 22-24, 28-34 and 37-43 and 46 are pending. Claims 3, 4, 20, 28, 29, 37-41 and 46 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,919,302 ('302). Claims 9, 11, 13, 15, 17, 19, 22, 24, 30, 30-34, 42 and 43 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,919,302 ('302).

B. Rejection under 35 U.S.C. §102(b)

Reconsideration is respectfully requested of the rejection of claims 3, 4, 20, 28, 29, 37-41 and 46 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,919,302 ('302).

Claim 37 is directed to a single crystal silicon ingot which, after being grown and cooled from the solidification temperature, has a constant diameter portion comprising multiple axially symmetric regions alternating along the axis of the ingot between a region wherein crystal lattice vacancies are the predominant intrinsic point defect and regions wherein silicon self-interstitials are the predominant intrinsic point defect. More precisely, the ingot of claim 37 has at least 2 interstitial dominant regions which are substantially free of agglomerated interstitial defects **separated by a vacancy dominant region along the axis of the constant diameter portion of the ingot.**

In contrast to claim 37, the '302 patent fails to disclose any silicon ingot having at least 2 interstitial dominated regions which are substantially free of agglomerated interstitial defects separated by a vacancy dominant region along the axis of the constant diameter portion of the ingot. The Office asserts that Fig. 14 is an image of a single crystal silicon ingot having multiple regions running along the axis with one vacancy region and two interstitial regions and that the **vacancy** dominated region is separated by **two interstitial-dominated regions** which are substantially free of

agglomerated intrinsic point defects. However even if this were true, the ingot would not anticipate the ingot of claim 37. The ingot of claim 37 requires that the ingot have **two interstitial dominated regions** which are substantially free of agglomerated intrinsic point defects which are **separated by a vacancy dominant region**.

While Fig. 14 is an image of an axial slice of an ingot having multiple regions along the axis, it does not have the regions required by claim 37. The characteristic regions of the ingot shown in Fig. 14, starting from the left side and moving along the axis towards the right as they appear in the image, are: (i) vacancy dominated material; (ii) interstitial dominated and agglomerated defect-free material; (iii) interstitial dominated agglomerated defect-containing material; (iv) interstitial dominated and agglomerated defect-free material; and, (v) vacancy dominated material. Thus, the ingot in Fig. 14 has two vacancy dominated regions separated by two interstitial dominated agglomerated defect free regions and an interstitial dominated agglomerated defect containing region. Significantly, the two interstitial dominated agglomerated defect free regions are separated by an **interstitial** dominated agglomerated defect containing region; they are not separated by a **vacancy** dominated region. In contrast, the ingot of claim 37 requires at least two interstitial dominated agglomerated defect-free regions which are separated by a **vacancy** dominated region.

Thus, Applicants submit that claim 37 is patentable over the '302 patent since the '302 patent fails to disclose the requirements of claim 37, namely an ingot having two interstitial dominated agglomerated defect free regions separated along the axis by a vacancy dominated region.

Claims 3, 4, 20, 28, 29, 38-41 and 46 each depend directly or indirectly from claim 37 and as such are patentable over the '302 patent for the same reasons as discussed above with regards to claim 37.

C. Rejection under 35 U.S.C. §103(a)

Reconsideration is respectfully requested of the rejection of claims 9, 11, 13, 15, 17, 19, 22, 24, 30, 30-34, 42 and 43 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,919,302 ('302).

It is alleged that the '302 patent, in particular Fig. 14, discloses a silicon ingot having multiple regions along the axis with one region which is vacancy dominated and two regions in which interstitials are the predominant intrinsic point defect wherein the vacancy dominated regions separate the two interstitial dominated regions which are substantially free of agglomerated defects. However, this is simply incorrect.¹ As discussed above with regards to claim 37, the '302 patent nowhere describes such an ingot.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the reference itself or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. And third, the prior art reference must teach or suggest all the claim limitations. MPEP §2142. With all due respect, the Office has failed to establish a *prima facie* case of obviousness. Specifically, the cited reference does not teach or suggest a single crystal silicon ingot having two interstitial dominated agglomerated defect free regions separated along the axis by a vacancy dominated region.

The '302 patent teaches a process wherein the growth conditions are controlled to maximize the radial and axial length of vacancy and/or interstitial dominated agglomerated defect free region(s) including a process for growing a silicon crystal wherein the entire constant diameter portion of the ingot is either vacancy or interstitial

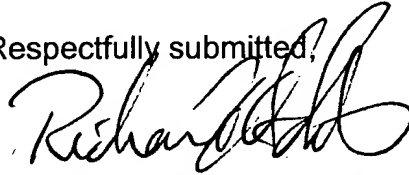
¹ In fact, the Office describes Fig. 14 as an image of an ingot where vacancy dominated material is separated by interstitial dominated material (See the DETAILED ACTION, item 3, paragraph 2 line 6-8 of the Office Action).

dominated and agglomerated defect free material. In addition, the '302 patent describes embodiments having both vacancy and interstitial type regions concentrically positioned relative to each other. While the '302 patent does allow for some variation in the growth conditions as a function of axial length; it is equally true that the '302 patent teaches that the pull rate should be controlled to a relatively constant rate during the growth of both the constant diameter portion of the crystal and the end cone to maximize both the radial width and axial length of the region(s). In contrast, the present invention requires controlling the growth parameters to **intentionally** vary the ratio v/G_0 , in at least one embodiment by intentionally varying the pull rate, to cause the predominant intrinsic point defect type to alternate between interstitial dominant material and vacancy dominant material. Simply put, persons skilled in the art, given the teachings of the '302 patent, would not be motivated to produce an ingot having the claimed number of vacancy dominated regions N , the claimed ratio L_{vac}/L_{int} as required by the pending claims. The '302 patent teaches away from the process and therefore the ingot of the present invention in that the '302 patent teaches that the pull rate should be controlled to a relatively constant rate during the growth of both the constant diameter portion of the crystal. Accordingly, Applicants respectfully submit that claims 9, 11, 13, 15, 17, 19, 22, 24, 30, 30-34, 42 and 43 are not obvious and, as such, are patentable over the cited art.

CONCLUSION

* Enclosed is a check in the amount of \$420.00 for a two-month extension of time.
The Commissioner is hereby authorized to charge any underpayment and credit any overpayment of government fees to Deposit Account No. 19-1345.

Respectfully submitted,



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RAS/skd
*Enclosure